



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

A CONTRIBUTION TO THE STUDY OF MALIGNANT GROWTHS IN THE LOWER ANIMALS.

BY MISS EVA H. FIELD, Des Moines, Ia.

Diseases among animals used for food, and also the horse, have received much attention, but domestic pets, especially cats, have been in a measure neglected. We know these animals are subject to contagious diseases, according to Osler, children have caught diphtheria from cats ;¹ they have angina, colitis and asthma ; dogs have often been affected with cancerous growths, also cattle and fowls.

In order to prove that a certain micro-organism is the cause of a given disease, Koch's rules are generally accepted.

First, it must be proven to be present in every case of the disease in question.

Second, the micro-organism must be isolated and cultivated on nutrient fluids outside the body.

Third, a pure cultivation thus obtained must produce the same disease when introduced into the body of a healthy animal.

Fourth, the same micro-organism must be found in the animal inoculated.

The Protozoa supposed to be the cause of malignant growths have not been demonstrated by the above rules. They have not been cultivated on artificial media or shown by the ordinary staining methods. That recommended by Soudakowitch as giving constant results consists in, fixing in Fleming's Solution, stain with saturated aqueous solution of safranin for one to four days, decolorize with acid alcohol.

NOTE.—By direction of the Exexecutive Committee this article has been somewhat condensed by the Secretary.

No definite conclusions seem to have been arrived at respecting the proper biologic classification of the "inclusions." In a round celled sarcoma of the testis, I. I. Clarke⁹ thought two-thirds of its weight was "psorosperms," but the morbid growths committee of the London Pathological Society called them "giant cells." Boeck,¹¹ in a case of Darier's disease, found the "psorosperms" to be large round epidermal cells, partly cornified with a nucleus and granules in their protoplasm. Staining showed no organization like known coccidia. Krosing¹² in a similar case arrived at the same conclusion. Heneage Gibbs¹³ thinks the alleged coccidia are simply cells undergoing endogenous division, and nothing which can be considered parasitic. Shattuck and Ballance¹⁴ demonstrated bodies resembling the fuchsin bodies of Russell from tubercular lymphatic glands and diphtheritic tonsils.

On the other side Ruffer and Plimmer¹⁵ find in fifty cases of cancer of the breast the above described Protozoa.

It is said the lower animals cannot be infected with carcinoma or sarcoma from the human subject or any animal but their own kind. Of the latter method of infection we have numerous examples, and as a further contribution to the subject I wish to report the following cases:

Case 1. Cystic Round-celled Sarcoma.—The first case to which I wish to call attention is that of a supposed abscess below the ear of a cat. A swelling appeared close to the ear and in a short time began discharging a foul-smelling purulent material. Aside from this the animal was to all appearances healthy. The cat was chloroformed and a portion of the diseased tissue was cut out and brought to the laboratory for examination. There was a space about five centimetres in diameter where the hair had fallen out, and in the center of this space the tumor had opened.

The tissue on section had a honey-combed appearance. No examination of the viscera was made. Viewed with the microscope this growth was found to be a cystic round-celled sarcoma.

Case 2. Scirrhous Carcinoma of the Mammary Gland.—A cat between fifteen and sixteen years of age was noticed to have a hard lump on one of the mammary glands, which grew steadily for about six months. The animal became very much emaciated and was noticed to cough. One evening she was found apparent-

ly suffocating, and her mistress hastened her death with chloroform.*

She cut out the growth including the mammary glands and brought the specimen to the laboratory for examination. On making sections and examining them it was found to be a carcinoma of the scirrhus variety. As none of the viscera could be obtained the case is necessarily incomplete, but from the fact that the cat coughed much of the time, and finally so nearly died of suffocation, I think it highly probable that there were metastases in the lungs and other organs. It is a noteworthy fact that this cat was in age equivalent to fifty or sixty years in the human subject and that pregnancy had not occurred for three years prior to death.

Case 3. Primary Mammary Cancer with Metastases.—A few months after the death of the cat in case 2 a lump was noticed on the breast of another one. This animal had been picked up as a stray kitten eight years before, hence the idea of heredity can be excluded. Knowing that the other cat had had cancer the lady very kindly gave me the valuable opportunity of studying this case. The history is given as she gave it to me.

After first noticing the lump it increased in size and remained hard for a period covering five months, when, she, thinking it was an abscess, poulticed it, and after that it ulcerated and for ten weeks discharged a purulent substance. During this time the cat became much emaciated and after ulceration had commenced seemed to have considerable fever and thirst. Incontinence of urine was present and micturition was painful, causing an outcry. The bowels were regular. Paroxysms of coughing were noticed.

To end her sufferings chloroform was administered, and on making an autopsy I found a hard tumor the size of a hen's egg in the left posterior mammary gland near to the anterior border of the nipple, which was not involved. The other mammary

* The lady who owned this cat and the one reported in case 3, is quite a cat fancier, being the owner of some seven or eight, in the care of which she spends most of her time. The cats are not allowed to raise their kittens, they being taken away during the first week after birth. The lady attends to the breasts as well as possible, bathing them, etc., to reduce the swelling. The information concerning the cats was all obtained from her and is perfectly reliable.

glands were somewhat enlarged and hard, as were also the numerous lymphatics in the inguinal and axillary regions.

A few nodules were found on the peritoneum ; the mesenteric glands were enlarged ; one nodule the size of a pea was found on the serous surface of the stomach and numerous nodules were found on the serous surface of the intestines throughout their entire length. These growths did not seem to extend through to the mucous membrane of the stomach or intestines, and the microscope proved this to be so.

The spleen was much enlarged and contained besides a number of small nodules, three white masses three centimetres in diameter and about one centimetre in thickness, over which the capsule was tense and glistening. The kidneys were somewhat enlarged and studded with numerous white nodules from five to ten mm. in diameter, to which the capsule was adherent though otherwise free. The cut surface shows also some white areas in the cortex which do not extend to the capsule.

The connective tissue between the kidneys contained a bunch of enlarged lymphatic glands.

The ovaries were examined and found to be diseased, the right containing a small cyst and the left being firm and hard to the touch. The right horn of the uterus was apparently normal, but the left contained about one and one-half centimetres from the ovary, a lump about the size of a filbert.

On opening the thorax, the anterior mediastinal glands were found to be enlarged and hard. On the external layer of the pericardium were several small nodules.

The heart on the cut surface revealed a nodule three millimetres in diameter in the apex.

The lungs were enlarged, completely filling the cavity, but were removed with ease as there were no adhesions. There was scarcely any of the normal lung tissue to be seen on the external surface, they being completely filled and covered over with nodules varying in size from one to ten millimetres. A small area at the apex on each side was free from nodules.

The lungs had, if examined apart from the other viscera, the appearance of miliary tuberculosis. The nodules were hard and felt like shot and were all under the pleura which showed no signs of inflammation. An examination of the brain, I regret to say,

was not allowed. However, from what I can learn, there were no apparent symptoms of motor or sensory disturbance, the animal retaining its intelligence to the last.

Surprising as it seems, after carefully examining every part of the liver, there were absolutely no appearances of invasion.

MICROSCOPIC EXAMINATION.

As the specimens were not obtained until some hours after death, the material was only hardened by two methods, alcohol and Müller's fluid. Cutting was done by the freezing method.

Stained with logwood, the primary growth presents over its surface a very thin layer of epithelial cells much flattened in appearance and taking a very deep stain, in some places only a fine dark line being visible.

Running down from the superficial epithelium are a few hair follicles, sebaceous and sweat glands, the greater number of which are surrounded by a zone of round-celled infiltration. Other evidences of inflammation are present, as in the connective tissue lying immediately beneath the epidermis a large area of granulation tissue occurs, in which we see connective tissue, fibres and cells, the latter being for the most part fibro-blasts, and may be seen varying in shape from round and oval to elongated cells with prolongations. A large number of blood vessels are also found in this area, one being cut lengthwise so it can be traced entirely across the field. The capillaries may easily be distinguished from the newly forming blood vessels, as the former, even when so small as to only admit a layer or two of corpuscles contain blood.

Below this area we have the fibres forming themselves into a stroma, in some places very delicate with very small alveoli, in others it is much thicker and the alveoli larger. These alveoli all contain epithelial cells of the glandular variety and many of them are seen to communicate with each other through openings in the stroma, which is exceedingly well supplied with blood vessels.

The cancer cells present a variety of appearances, some of them being round, others oval, and still others spindle in shape, whilst in size many of them might be mistaken for leucocytes, while others are as large as the cells of a squamous epithelium; in fact, in several places collections of cells are to be seen, which

both in their shape and arrangement resemble the "bird's nests" of that growth.

The arrangement of the cancer cells throughout the growth presents a great variety of appearances, as may be noticed from the size and shape. In some parts we find a single layer of cells, cubical in shape and nucleated, arranged around the alveolus, and in these places we find the central portion filled with a delicate homogeneous substance, taking a very light stain; in other places the alveoli are packed with cells, which seem to have lost their well-defined shape and are round and oval in appearance, some small, others very large and multinucleated, some presenting the appearance of endogenous cell division.

The blood vessels, instead of being confined to the fibrous stroma, in many places seem to penetrate it and run in direct contact with the cells. This, our text books tell us, is seldom if ever seen in the carcinomata, they even go so far as to give that as a means of differentiating alveolar sarcoma from carcinoma.

Another fact noticeable about the blood vessels is the contents, the white blood corpuscles in some nearly equalling the red in number. There are, in the center of the growth, two well marked areas of infiltration of leucocytes, closely packed together and deeply stained, while red corpuscles and a few leucocytes may be seen in the connective tissue between these areas and a large vessel near by, and may also be seen in the vessel wall. These cells have undoubtedly escaped from the vessel described, as their course is plainly visible.

In another vessel I find a blood clot which was probably a thrombus. Red and white blood corpuscles are present inside the lumen, the latter being massed in the center; amongst these are some spindle shaped cells, probably fibro-blasts, and the whole is held together by a network of fibrin, well seen at the periphery of the clot and attached to one side of the lumen. Here and there are a few large cells, probably the cancer cells, which have invaded the wall and in some cases have passed through. In about the center of the specimen, and in all specimens examined in comparatively the same position, is a large area of degeneration, including both the stroma and the cancer cells, the former seeming to be first affected. The connective tissue fibres first assume a swollen, cloudy appearance, next the corpuscles are missed, and

ultimately the whole framework is lost sight of and we have in its place a granular homogeneous material, the exact appearance of granular cloudy swelling. Where we find the cancer cells just beginning to degenerate there will be occasionally a nucleus missing, the cells become cloudy and swollen and finally, like the fibres, lose their outline and we see the same homogeneous material, which very closely resembles hyaline degeneration. It does not stain with logwood but stains fairly well with aurantia. A number of cysts are present, varying in size, some containing cystic material, others not, and some with a little of the cystic material still clinging to the walls. Some of these cysts are round, while others are very irregular in outline.

Lymphatic Glands.—The first to be examined was the left inguinal gland, and as the others present the same appearance only this one will be described. The capsule for the greater part of the circumference is not increased in thickness; however, in one portion the fibres have separated and enclose in their network a large number of cancer cells. We also find in the capsule the blood vessels congested and in some places clots containing fibrin are present. There is also proliferation of the spindle shaped fibro-blasts.

In the gland substance we find the lymph sinuses everywhere invaded by the cancerous stroma, containing the same variety of epithelial cells as are met with in the primary growth.

In the center of the gland we here met with the same hyaline degeneration as has already been described.

The Lungs.—Beginning at the outer surface we find the pleura is neither thickened or congested, but immediately under it there are found large numbers of cancer nodules which differ but slightly from those already described, the main difference lying in the relative amount of stroma and cancer cells, the latter being much more abundant in the lungs than the former and very densely packed together. The degeneration is also found here and is not confined to the cancerous portion but may frequently be found in the alveoli a granular debris, in some places entirely filling the spaces.

Aside from the cancer nodules the lungs are found to be in a state of chronic venous congestion. The capillaries are very much congested, the interalveolar septa thickened, the alveoli

here and there contain *a few* scattered epithelial cells and detritus and in others are entirely filled. Some of the cells seen in the alveoli are of unusually large size and lie singly in the middle of an alveolus while others are small and closely massed together.

Emphysema and bronchiectasis are also present, as well as some well marked endarteritis.

Heart.—The heart muscle does not show much change although there is some myocarditis.

Cancerous nodules are found in the apex and are microscopic in size, only one being visible to the naked eye, while fifteen can be counted in the specimen under examination. These nodules are without doubt the result of a recent invasion. The stroma is delicate, cells stain deeply, and may be seen in large numbers in some places infiltrating the heart muscle, the fibres of which are pushed to one side, in others entirely replaced by cancerous stroma and cells.

Another reason for considering this a recent invasion is that there is no sign of degeneration present but, instead, a rapid proliferation of tissue.

The question arises, how did this infection of the heart take place. There are three possible ways, viz. : from the blood as it passes through the ventricle, by the lymph spaces in the serous covering, or by the nutrient arteries of the heart.

The first is hardly probable as there would probably be enough force used in propelling the blood from the ventricle to thoroughly wash the walls of the cavity.

There is, I think, a possibility of either the second or third ways having caused the infection. In the second, it will be remembered that the lungs were almost entirely covered with nodules, and while to all appearances none of them had penetrated the pleura, yet it would be comparatively an easy matter for this to have taken place and we not be able to demonstrate it, and as the portion of the heart which was infected laid in direct contact with the lungs, and the two were abnormally close together, due to the increase in size of the lung, it would seem to be an easy matter for infection to take place from one membrane to the other by means of the stomata or lymph spaces known to exist in such membranes.

In the third possible reason, there is a strong probability that

in a case of such general metastases as there is here, infection was being carried by the blood, and if such were the case, as the nutrient artery breaks up and supplies nourishment to all of the heart muscle, this seems a very probable way for the infection to have taken place

Intestines.—The growth in the intestines seems to be between the longitudinal and circular muscle layers, the two apparently having separated to allow the cancerous nodule to form there and so grow as it does from the muscular coat. The description need not be repeated, for this specimen microscopically is the same as those already described, the position being the point most worthy of attention.

The cancer does not penetrate the circular coat of muscle fibres, however, we find the mucosa considerably altered, possibly from pressure. The villi in some places are absent, in others much diminished in size.

The Kidneys.—Nodules are raised above the surface of the kidneys although they do not penetrate the capsule. Others, microscopic in size, are found to extend down into the parenchyma. The description would be a repetition of what has already been given, except that the cells are many of them very large and arranged in groups as in the epitheliomata. The epithelium of the uriniferous tubules is cloudy and swollen so as to nearly fill the lumen. The nuclei are plainly visible. There is some glomerulitis present, and Bowman's capsule is in many places thickened.

The spleen is only different in that the degeneration is more advanced, as might have been expected from the size of the nodules. The other organs, uterus, pancreas, supra renals, will not need description, inasmuch as they are identical with those already described.

The liver was very carefully examined both macro and microscopically and no cancer was found. There is hepatitis present, the cells in some places have fallen out, leaving only a reticulum visible. In other places there is an overgrowth of the connective tissue and evidences of necrosis.

CONCLUSIONS.

1. That the malignant tumors of the human species have their homologue in the lower animals.

2. That we have in this particular case a scirrhus cancer of the mammary gland, followed by metastatic deposits in the lymphatic glands, lungs, heart, stomach, intestines, uterus, ovaries, kidneys, and supra renal capsules. The means by which this growth became so generally disseminated was probably by the lymphatics to the nearest lymphatic glands, from them of course it is easily traced through the thoracic duct to the circulatory system, but why the liver should have escaped is hardly to be explained.

3. Two cats living in the same house were infected inside of a year. The question arises, did the second cat receive its infection from the first, were they both spontaneous cases, or have we here another house from which successive cases of cancer will occur, or did the oft-repeated drying of the breasts give sufficient irritation to cause the proliferation of the glandular epithelium. I will not venture to give an opinion, but shall anxiously watch for further developments in those animals still remaining in the house.

Care should be taken by parents and those having children in charge to see that the animals they play with are free from disease. True, it is said that infection only obtains between those of the same species, still because experiments in this direction have failed, we must not make up our minds it has been absolutely demonstrated that there is no danger from contact.

BIBLIOGRAPHY.

-
2. British Medical Journal, 1891, Vol. I, p. 283.
 3. Journal of Anatomy and Physiology, Vol. XIV, p. 42.
 4. Journal of Anatomy and Physiology, Vol. XIV, p. 292.
 5. New York Medical Journal, Vol. XXXVIII, p. 659.
 6. Proceedings Am. Soc. Microscopists, 1883, p. 125.
 7. Trans. Pathological Soc. of London, Vol. XLI.
 8. Lancet, and British Medical Journal, May 6, 1893.
 9. British Medical Journal, Vol. I, p. 119.
 10. "On the So-called Parasitic Protozoa of Cancer" by John Lindsay Stevens and John Brown. Jour. Path. and Bact., Vol. II, No. 1.
 11. Archiv für Derm und Syph. Heft VI, 1892.
 12. Monats f. prakt. Derm. No. II, Nov. 15, 1892, p. 498.
 13. Amer. Jour. Med. Sciences, Vol. CVI, No. 1.
 14. "A Short Record of Work Done on the Pathology of Cancer during the last few years," by Samuel G. Shattuck and Charles W. Ballance. B. M. J., 1891, Vol. I, p. 565.
 15. Further researches on Parasitic Protozoa in Cancerous Tumours, by M. Armand Ruffer and H. G. Plimmer. Jour. Path. and Bact., Vol. II, No. 1.
 16. Archives für Klinische Chirurgie, Band XLVI, Dr. Geissler.
 17. B. M. J. Supplement, 1891, Vol. II, p. 184.
 18. British Medical Journal, Vol. I, p. 293.
 19. British Medical Journal, Vol. I, p. 292.
- CATTLE, C. H. "Observations on the Histology of Carcinomata and the Parasite-like Bodies found in them." Jour. of Path. and Bact., Feb., 1894.
- GIBBES, HENEAGE. "Practical Pathology and Morbid Histology," 1891.
- LANDOIS AND STIRLING. "A Text Book of Human Physiology."
- OSLER, WM. The Principles and Practice of Medicine, 1893.
- POWER, D'ARCY. "A Comparison of the Results obtained from the Inoculation of portions of Tissue affected with Paget's Disease and of Coccidia." Jour. of Path. and Bact., November, 1893.
- PLIMMER, H. G. "The Rhopalocephalus Carcinomatosus." Jour. of Path. and Bact., May, 1894, being a review of Dr. Alexis Horotneff's paper, "Untersuchungen ueber den Parasitismus des Carcinoms."
- SUTTON, J. BLAND. "Tumours Innocent and Malignant, their Clinical Features and Appropriate Treatment," 1893.
- WOODHEAD, G. SIMS. "Practical Pathology." Third Edition, 1892.
- ZIEGLER, ERNST. "A Text Book of Pathological Anatomy and Pathogenesis." English Translation by Donald Macalister, 1886.